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1. **Discuss Ovulation**

Ovulation is the release of a secondary oocyte from the ovarian follicle. Few days before ovulation, the secondary follicle grows to a diameter of about 25mm under the influence of Follicle stimulating hormone and luteinizing hormone to become Graafian follicle. Coincident with the final stages of development of the vesicular follicle, there is an abrupt increase in LH that causes;

i. The primary oocyte to complete meiosis 1
ii. The follicle to enter preovulatory mature vesicular stage.

Meiosis II is also initiated but the secondary oocyte is arrested in metaphase approximately 3 hours before ovulation. The surface of the ovary then begins to bulge locally and at the apex an avascular spot, the stigma appears. For the oocyte to be released, 2 events occur which are caused by LH surge:

i. Increase in collagenase activity which results in the digestion of collagen fibers (connective tissue) surrounding the follicle.
ii. Prostaglandin levels also increase which results in the local muscular contractions of the ovarian wall.

These contractions extrude the oocyte from the ovary, which together with its surrounding follicular cells from the region of cumulus oophorus. This causes *ovulation* in which oocyte floats out of the ovary. Some of the cumulus oophorus cells then rearrange themselves around the zona pellucida to form the corona radiata.

2. **Differences between meiosis 1 and 2**

Meiosis 1	Meiosis 2
Reduces the ploidy number from 4n to 2n (reduction)	Divides the remaining set of chromosomes from 2n to n(division)
Synapsis, crossing over and chiasma formation are all present.	Synapsis, crossing over and chiasma formation are absent. Nuclear envelopes also dissolves.
Centromeres do not split.	Centromeres split.
Formation of 2 secondary gametocytes (23 duplicated chromosomes)	Formation of four gametes (23 single chromosomes).
Homologous chromosomes separate	Sister chromatids separate
It starts as diploid and ends as haploid	Starts as haploid and ends as haploid.
Prophase splits into 5 sub phases.	Prophase does not have sub phases.

3. **Stages involved in fertilization**

Fertilization is the union of the sperm and oocyte. There are six stages involved in fertilization:

I. Passage of a sperm through the corona radiata: for sperms to pass through the corona radiata, they must have been capacitated (the removal of glycoprotein coat and seminal proteins from the plasma membrane).
II. Penetration of the zona pellucida: the zona is a glycoprotein shell surrounding the egg that facilitates and maintains sperm binding and induces the acrosome reaction. The acrosome of the sperm binds with a zona glycoprotein on the zona pellucida. Release of acrosomal enzymes acrosin allows sperm to penetrate the zona pellucida thereby coming in contact with the plasma membrane of the oocyte. As soon as the head of the sperm touches the plasma membrane of the oocyte, the permeability of the zona

pellucida changes. Lysosomal enzymes are released from the cortical granules lining the plasma membrane of the oocyte when the sperm comes in contact with the oocyte surface. These enzymes alter properties of the zona pellucida to prevent sperm penetration and inactivate binding sites for spermatozoa on the zona pellicida surface.

III. Fusion of plasma membranes of the oocyte and sperm: the plasma membrane of the oocyte and sperm fuse and break down at the area of fusion. The head and tail of the sperm enter the cytoplasm of the oocyte but the sperm's plasma membrane remains behind.

IV. Completion of the second meiotic division of oocyte and formation of female pronucleus: penetration of the oocyte by a sperm activates the oocyte into completing the second meiotic division and forming a mature oocyte and a second polar body. The nucleus of the mature ovum/oocyte is called a female pronucleus.

V. Formation of male pronucleus: within the cytoplasm of the oocyte the nucleus of the sperm enlarges to form the male pronucleus and the tail of the sperm degenerates. The oocyte contains two pronuclei and is now called an ootid.

VI. The 2 pronuclei fuse into a single diploid aggregation of chromosomes and the ootid becomes a zygote.

4. Differences between monozygotic and dizygotic twins.

MONOZYGOTIC TWINS	DIZYGOTIC TWINS
Formed by one sperm and one egg.	Formed by two different sperm and eggs.
They nearly have an identical genetic code.	Like any other siblings their genetic code differs.
Usually of the same gender	Usually of different genders.
Almost always have the same blood type.	They may have different blood types.
Resemblance is similar	Resemblance is just like any other two siblings
They are often called conjoined twins.	Not seen as conjoined twins.
They are mostly diamniotic, mono-chorionic with single placenta.	Mostly have two amnions, two chorions and two placentas.